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September 2, 2003

Mr. William G. Pennington
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: 2005 Energy Efficiency Standards – Outdoor Lighting

Dear Bill:

Acuity Brands Lighting is the largest manufacturer of luminaires and lighting equipment in North America with sales over $1.5 billion. Acuity Brands Lighting includes highly recognized brands in outdoor lighting including Lithonia, Holophane, American Electric Lighting, Hydrel and Antique Street Lamps. Acuity Brands Lighting is a primary supplier of outdoor lighting equipment to California.

Acuity Brands Lighting is very involved in energy effective lighting through standards development and product technologies. Our company has demonstrated our support for energy efficiency measures on numerous occasions. We have supported the Title 24 2005 requirements for residential lighting. We are currently participating with CEC, SMUD and LBNL through the CEC PIER programs on the development of energy efficient lighting systems. We have been actively engaged in the establishment of the California Lighting Technology Center and appreciate CEC's support for this facility, which has a high potential to influence energy effective lighting strategies. We have been engaged with the Title 24 outdoor lighting standards development for over 2 years, prior to the first public workshop. Our commitment to this standards development activity is focused on developing meaningful standards that help California address energy demand and efficiency requirements, which also ensure that the citizens of the state are provided with effective lighting to support nighttime visibility and safety.

We have attended public workshops, met individually with CEC staff and dedicated significant time to work directly with CEC contractors on the outdoor lighting requirements for Title 24 2005. We have made some progress in discussions with Jim Benya since April 2003, however two significant issues remain unresolved. These two issues are:

1. the manner in which the CEC is defining the nationally and internationally recognized lighting zone concept
2. the proposed power density values for certain application measures.

Lighting Zones

The definition for lighting zones in the Title 24 2005 language is not consistent with IESNA or CIE. Because the lighting performance requirements (and subsequently the power density) relate directly to theses definitions, this is a critical element in evaluating the appropriateness of the proposed power density limits.

IESNA Definition of Environmental Zones (RP-33-99)

Zone E1: *Areas with intrinsically dark landscapes* – examples are national parks, areas with outstanding natural beauty, or residential areas where inhabitants have expressed a strong desire that all light trespass be strictly limited.

Zone E2: *Areas of low ambient brightness* – these may be outer urban and rural residential areas.

Zone E3: *Areas of medium ambient brightness* – these will generally be urban residential areas.

Zone E4: *Areas of high ambient brightness* – normally these are urban areas having both residential and commercial use and experience high levels of nighttime activity.

CIE: Environmental Zones (CIE 150:2003)

Zone	Surrounding	Lighting Environment	Examples
1	Natural	Intrinsically dark	National parks or protected sites
2	Rural	Low district brightness	Industrial or residential rural areas
3	Suburban	Medium district brightness	Industrial or residential suburbs
4	Urban	High district brightness	Town centres and commercial areas

CEC Lighting Zones (2005 Building Energy Efficiency Standards – July 2003*)

Zone	Ambient Illumination	Statewide Default Location
1	Dark	Government designated parks, recreation areas, and wildlife preserves
2	Low	Rural areas, as defined by the 2000 U.S. Census
3	Medium	Urban areas, as defined by the 2000 U.S. Census
4	High	None

* CEC has defined provisions to allow a jurisdiction to adopt a higher or lower zone by following a public process. This process limits the adoption of higher zones to no more than 20% of the total dry land area.

By referencing the Census map and based on CEC definitions of Lighting Zones, the areas shown in purple are in LZ3. The area not highlighted would be LZ2 unless it is a designated state park or other LZ1 area. LZ2 represents a significant area of the state and many commercial areas will be in LZ2. According to both the IESNA and CIE definitions, commercial areas should be defined as zone 4. There is a significant deviation from the CEC approach to lighting zones as compared to national and international standards, which will impact lighting levels and power density limits.

Ref: U.S. Census Bureau – Census 2000

We recognize that some municipalities want a process to control excessive lighting in their district, but they also want to support industry standards and guidelines without adding administrative burden on their limited staff resources. California has defined provisions to go through a public procedure to move up or down a zone, therefore a municipality could go through the public process to move an urban zone 4 area as defined by IESNA and CIE down to a more restrictive zone. We would propose that the CEC standards should be consistent with IESNA and CIE with urban and commercial areas defined as LZ4. If CEC maintains their current definition with LZ3 as "urban", the power density limits associated with LZ3 should reflect urban lighting performance metrics, which are higher than the current assumptions used in the CEC models.

Proposed Power Density Values

There has been significant discussion over the last 2 years about the justification for the proposed power density values. In April 2003, after several requests and after the final public workshop, I was provided the details of the models. I had a number of questions about the applicability of assumptions and how well the models represent California sites. The most significant issue relates to the assumption of **how much light is required for specific applications**, specifically when considering security of people and property. The initial CEC models proposed a maximum power density based on IESNA Recommended Practices that provide recommendations for a minimum illuminance level. RP-20-98 also indicates that in areas where nighttime activity levels are high, the immediate surrounding area may require illuminance levels substantially greater than the enhanced security illuminance recommendations in RP-20-98. Mr. Benya has reevaluated the models and made various adjustments accordingly.

Taking parking lots as an example, the data provided in the July 2003 Staff Report (Table A-1) does not include any data for zone 3, however referencing data provided directly to me by Mr. Benya, the zone 3 models are based on 1.8 fc average. The IESNA has recently published G-1-03, *"Guideline for Security Lighting for People, Property, and Public Spaces"*. Guidelines in this national document, approved by the IESNA board, reference various criterion related to designing for security requirements including glare, light pollution, light trespass, illuminance and uniformity. The IESNA Guideline references the need for major retail parking lots to design for illuminance levels as high as 5 fc average with strict uniformity requirements. If the Title 24 outdoor requirements for parking lots proceed as currently proposed, these major retailers would be required to limit the power density to a level that would only support about 2 fc average if they are in zone 3, less than half the amount recommended by IESNA to support security lighting guidelines. If these retailers are located in zone 2, their illuminance levels would be even further restricted below IESNA guidelines. Appendix A shows typical lighting performance and power density for retailers who conduct business in the state of California in LZ3 and LZ2 for your reference.

In my discussions this spring with Mr. Benya, I have proposed that these standards consider including two categories for measures: (1) non-retail sites

or areas with moderate activity and security requirements and (2) retail sites or areas with high activity and security requirements. The proposed two-category approach maintains the current 45-day language LPD values for moderate security and new LPD values for retail or high security areas. This approach would allow CA to achieve significant energy reductions in areas with moderate requirements, while balancing the energy and security tradeoffs for areas with higher requirements.

IESNA G-1-03 covers other outdoor applications beyond parking lots that are proposed in the California Title 24 outdoor lighting requirements. Appendix B is compares some IESNA G-1-03 guidelines to the CEC Title 24 models.

For the building façade measure, there have not been any models provided to support this measure other than the summary data provided in Table A-8 of the July 2003 staff report (also included in the June 2002 report). The ASHRAE proposed standard for facades has a lower power density than CEC, however the ASHRAE LPD calculation includes the entire surface area of the façade, not just the illuminated area as defined by Title 24. The dimensions of facades studied by CEC and the lamp types may not be representative of typical building facades. Furthermore, façade lighting is estimated to represent only 5-6% of the state's outdoor lighting installations, representing approximately 3% or less of outdoor lighting energy use. Assuming an aggressive energy savings potential of 20% through a power density limit, the overall energy savings impact would be less than 0.5%. Most facilities use separate controls for the façade lighting, which is more energy effective than limiting power density. It is questionable how effective this measure will be in reducing energy consumption and demand.

The summary section of this document outlines specific revisions to the power density limits in Tables 147A and 147B for the outdoor lighting based on the IESNA G-1-03 guidelines. These recommendations cover measures for (A) hardscape / parking lots, (B) hardscape / plazas, sidewalks, bikeways and walkways – method i and method ii, (C) facades and (D) alternate power allowances for ordinance requirements. Based on new IESNA guidelines, other measure may also require further analysis.

Summary of Recommendations:

The comments provided in this document focus on two issues: definitions of lighting zones and proposed power density values. Both issues relate to the impact on the resulting illuminance that can be provided to meet the energy standards and suggests that the current Title 24 proposals be reevaluated based on new information from IESNA related to security lighting.

1. **Lighting Zones**

   The Title 24 Lighting Zone definitions should be revised to ensure that urban areas in California will be illuminated to light levels that support the visual, safety and retail requirements of an urban area. **It is our recommendation that urban and commercial areas should default to the LZ4 category**,

which is consistent with national and international standards. If these definitions are not revised, the proposed power density limitations must be reevaluated to ensure that the lighting performance requirements for urban areas can be met with the LZ3 power density limitations.

2. Revise Power Density Limits

Our analysis of the CEC proposed power density in comparison to IESNA guidelines suggests that the current power density limits do not support security lighting requirements. **We proposed that the current CEC LPDs be maintained for areas with moderate security requirements, but that a new category is added for areas with high activity levels or high security requirements**. The analysis in Appendix B supports the following recommendations:

(A) Hardscape / Parking Lots:

Lighting Application	LZ 1	LZ 2	LZ 3	LZ 4
Hardscape for automotive vehicular use including non-retail parking lots or areas with moderate requirements for both activity and security	0.05 (same)	0.08 (same)	0.10 (same)	0.19 (same)
Hardscape for automotive vehicular use including retail parking lots or areas with either high activity or high security requirements	0.08 (new)	0.12 (new)	0.16 (new)	0.30 (new)

Driveways and site roads should be removed from this measure. The T24 45-day language – July 2003 covered driveways and site roads under two different power density requirements.

(B) Hardscape / Plazas, Sidewalks, Walkways, Bikeways (Method i):

Lighting Application	LZ 1	LZ 2	LZ 3	LZ 4
Hardscape for pedestrian use including plazas, sidewalks walkways and bikeways (Method i) - areas with moderate activity and security requirements	0.06 (same)	0.09 (same)	0.11 (same)	0.21 (same)
Hardscape for pedestrian use including plazas, sidewalks walkways and bikeways (Method i) - areas with high activity and security requirements	0.17 (new)	0.25 (new)	0.31 (new)	0.59 (new)

Hardscape / Driveways, Site Roads (Method ii):

The CEC proposals for this measure provide the flexibility to meet IESNA G-1-03 illuminance guidelines. **No revisions are required for this measure.**

(C) Building Facades:

It is recommended that this measure be reevaluated to determine its effectiveness in reducing energy demand. The energy used for façade lighting is very low. **We propose that the power density limit for facades be eliminated. A lighting control requirement (such as automatic shut off) may be incorporated to effectively reduce energy.** If CEC proceeds with a power density limitation, the following revisions are proposed.

Lighting Application	LZ 1	LZ 2	LZ 3	LZ 4
Building Facades – areas with moderate activity and security requirements	Not allowed (same)	0.18 (same)	0.35 (same)	0.50 (same)
Building Facades – areas with high activity and security requirements	0.18 (new)	0.51 (new)	1.00 (new)	1.43 (new)

(D) Table 147C:

Table 147C was designed to support ordinances with requirements for higher illuminance levels. **These values should be reevaluated based on changes to the models and criteria related to security lighting. Higher illuminance levels should be incorporated with the appropriate power density to support those illuminance levels.**

We are willing to discuss specific power density values in more detail with CEC staff and contractors. Since this is California's first attempt to regulate the energy associated with outdoor lighting, it is imperative that security issues be considered along with the energy impact. This proposal is a reasonable approach that achieves energy reductions, is based IESNA guidelines and allows businesses to maintain the proper lighting to support safety and security requirements in California.

Acuity Brands Lighting continues to be committed to working with the Commission to ensure the outdoor lighting standards are appropriate. Thank you for your time and consideration of these comments.

Best regards,

Cheryl R. English
Vice President, Technical Marketing Services

Appendix A

Examples of typical retail parking lot lighting specifications / performance

Retailer	Site Size	Ave fc	Min fc	Uniformity	Typical LPD	T24 LPD
A	Large (300,000 sf)	4.0 – 4.5	1.0	4.0 – 4.5 : 1	0.07 – 0.12	0.08 LZ2 0.10 LZ3
B	Large (200,000 sf)	4.0 – 4.5	1.5	2.7 – 3.0 :1	0.09 – 0.12	0.08 LZ2 0.10 LZ3
C	Large (200,000 sf)	5.0 – 10.0	2.5	4.0 : 1	0.21 – 0.26	0.08 LZ2 0.10 LZ3
D	Large (200,000 sf)	3.0	2.0	4.0 : 1	0.20 – 0.23	0.08 LZ2 0.10 LZ3
E	Medium (100,000 sf)	5.0 – 8.0	3.0	2.6 : 1	0.24 – 0.28	0.08 LZ2 0.10 LZ3
F	Medium (100,000 sf)	5.0 – 6.0	2.0	3.0 : 1	0.27 – 0.31	0.08 LZ2 0.10 LZ3
G	Medium (100,000 sf)	5.0 – 10.0	4.0	2.5 : 1	0.09 – 0.15	0.08 LZ2 0.10 LZ3
H	Medium (100,000 sf)	4.0 – 4.5	1.5	3.0 : 1	0.22 – 0.29	0.08 LZ2 0.10 LZ3
I	Small (40,000 sf)	5.0 – 6.0	2.0	2.5 – 3.0 : 1	0.22 –0.29	0.08 LZ2 0.10 LZ3
J	Small (40,000 sf)	3.0 – 5.0	1.5	3.5 : 1	0.10 – 0.14	0.08 LZ2 0.10 LZ3
K	Small (40,000 sf)	10.0	1.0	10:0 : 1	0.19 – 0.22	0.08 LZ2 0.10 LZ3

Power density values vary based on a variety of lighting criterion including source wattage, optical distribution of selected luminaires, pole height, site layout flexibility accommodating poles locations at optimal positions and performance specifications.

CEC models have been based on sites with simple shapes such as rectangles with no restrictions on pole locations. Irregular shaped sites will require higher power densities to provide safe and secure lighting. This is especially true for smaller sites.

By incorporating the proposed power density limits for retail or high security areas, CEC will realize substantial energy savings from less efficient sites while supporting the security requirements for efficiently illuminated sites.

Appendix B

Analysis of IESNA G-1-03 criteria versus CEC models

The following analysis lists performance criteria defined by IESNA G-1-03. The CEC Model column used the model that most closely matched the IESNA G-1-03 criteria, which was the CEC Lighting Zone 4 model. A complete analysis of the power density associated with the higher illuminance criteria to meet the IESNA G-1-03 is required, however a linear extrapolation from the power density determined in the CEC model is a reasonable estimate.

	IESNA G-1-03	CEC Model
Parking Lots		
Ave Horiz. Illum.	3 – 5 fc	2.9 fc
Uniformity	4:1 ave/min	12:1 max/min
Model Power Density	*Extrapolated from CEC model* 3 fc – 0.09 w/sf 5 fc ~ 0.16 w/sf	0.09 w/sf
T24 Proposed Power Density	3 fc – could meet LZ3, does not meet LZ2 5 fc – would not meet LZ3 or LZ2	0.08 w/sf (LZ2) 0.10 w/sf (LZ3)
Walkways		
Ave Horiz. Illum.	1 – 3 fc	1.9 fc
Uniformity	4:1 ave/min	3.5 : 1 max/min
Model Power Density	*Extrapolated from CEC model* 1 fc ~ 0.11 w/sf 3 fc – 0.31 w/sf	0.20 w/sf
T24 Proposed Power Density	1 fc – could meet LZ3, does not meet LZ2 3 fc – would not meet LZ3 or LZ2	0.09 w/sf (LZ2) 0.11 w/sf (LZ3)
Facades		
Ave Horiz. Illum.	5 – 20 fc	10 w/sf
Uniformity	8:1 ave/min	Information not provided
Model Power Density	*Extrapolated from CEC model* 5 fc – 0.25 w/sf 20 fc ~ 1.00 w/sf	0.50 w/sf
T24 Proposed Power Density	5 fc – could meet LZ3, does not meet LZ2 20 fc – would not meet LZ3 or LZ2	0.18 w/sf (LZ2) 0.35 w/sf (LZ3)